

31 May 2018, Comments regarding GN Docket No. 18-122

Federal Communications Commission
Office of Engineering and Technology, International, and Wireless Telecommunications Bureaus
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Washington, DC 20554

I am writing this as an interested party to the above mentioned request for public comment. I am a physicist by training and possess a number relevant backgrounds including: (1) broadcast and satellite RF engineering starting in the mid-1970s when I obtained a first-class radiotelephone license and served as chief engineer for radio/television broadcasters, (2) software development and hardware implementations for core Internet protocols and technologies for nearly 40 years, (3) a recognized National Asset as the Chief Scientist/Chief Technologist for multiple large aerospace corporations in the development of very high bandwidth digital signal processing algorithms and operational systems for the United States and allied foreign governments (since mid-1980s), and (4) development of computational algorithms and techniques for leveraging massive datasets over the past 20 years.

My particular interest is as an operator of eight C-band-class receive-only satellite antennas from 2.6 – 3.5m in diameter, for completely legal reception purposes for family and friends. I have multiple technical and procedural concerns with regards to the sharing and/or reallocation of the 3.7-4.2 GHz portion of the spectrum to include licensed and unlicensed mobile wireless technologies, and will address each concern as a separate topic.

What Level of Public Need Justifies Spectrum Reallocation?

For decades the majority of existing US electromagnetic spectrum allocations have remained constant. This has not stunted progress of the development of improved technologies and services for the wide range of radio and television broadcast, radar systems, and other communications and data transmission systems. Each service recognized fixed spectral limits and innovated within those constraints. As the FCC is well aware, Over-The-Air (OTA) TV broadcast channels have remained unchanged in bandwidth at 6 MHz since the origination of the NTSC standard in 1941. This same bandwidth supported the standards upgrade to color transmission in 1953, the eventual transition to ATSC in the 1990s, and ATSC 3.0 as of 2017. As a consequence, this bandwidth now supports nearly 25X the screen resolution and multiple subchannels. Also, unused guard channels are no longer required. The Commission and industry have managed this evolution to provide a minimal financial and usability impact on the public and broadcasters, and the resulting technical innovations have proved valuable in many other domains.

The insatiable appetite of the mobile wireless industry for increased spectrum has enabled and rewarded quite the opposite behavior. Each new technology generation has required additional allocations and inadequately addressed the rapid obsolescence of previous generations. There is no apparent end or plan of how a rapidly diminishing pool of spectrum reallocations can maintain future generations. The Commission and pre-existing spectrum users took unprecedented actions to free spectrum for mobile wireless use, and considerable assets changed hands. But a reasonable fraction of this bandwidth has not been put to immediate use, and in fact the strategies of certain auction winners were revealed to be only speculative in nature, rather than driven by any technical or public need. Useful electromagnetic spectrum is a finite resource, and turning it over for financial investment opportunity does not serve the public good when it removes spectrum that currently utilized for considerable public good. Such is the case for C-band, which provides services for hundreds of millions of people.

The mobile wireless industry has certainly provided revolutionary improvements to the public that have been widely accepted and embraced – it is estimated that 95% of Americans own at least one cell phone, and the immediate access to vast amounts of data we now enjoy could not have been imagined 20 years ago. But this does not mean this progress was managed appropriately or efficiently or exponential growth can continue or even makes sense when available spectrum is rapidly declining.

As someone who deals daily in TB, PB, and EB of data, I struggle to fathom how more bandwidth will significantly improve the public good with mobile wireless technologies. The market cap in terms of number of users has already been saturated – it can only increase because of population growth. I then look at what users can accomplish with more bandwidth, and find little. While the RF technologies of mobile wireless are highly efficient in terms of spectrum utilization, the actual efficiencies of moving the data itself are reprehensible. With few, if any, constraints on bandwidth and little responsibility for the cost, content providers have no motivation to supply data in anything but inefficient forms. Web pages now often require hundreds of individually downloaded elements to complete, and much of this is uncompressed, redundant, or undesired by consumers. But this garbage data explosion is precisely what the mobile wireless companies employ to justify their need for ever increasing bandwidth. If they and content providers lived on a responsible bandwidth diet, like nearly every other spectrum user, true innovations would have long come into play to achieve the same result at lower cost.

Thus we have a circular argument for increasing bandwidth needs, most of which is founded on forced obsolescence that does not benefit the public, which is captively forced to pay for unneeded and poorly implemented technologies they do not understand, want, or even benefit from. I will cite a couple of examples, but they are only representative of many others I see anywhere I look.

The first is the sales of 4K video to the mobile wireless public. Once the technologies existed to provide 720p and then 1080p video to consumers, cell phone, content, and wireless providers have moved on to justify why 4K video is desirable/necessary. Which is in conflict with physics, human anatomy, and practical reality: (1) above a certain size, mobile wireless devices are no longer convenient, and (2) the human eye is optically limited to an angular resolution of about 0.5 minutes under ideal conditions (daylight sun, 100% contrast, stationary object) and invariably far worse. Thus a fullscreen 4K video playing on a 6" cell phone would have to be held at a distance of 4.5" from a good set of human eyes to see any difference to a 1080p video. That distance is simply not typical, and arguably many people would not view a 1080p video at 9" to see a difference over a 720p video. This is as illogical as requiring every driver to purchase automobiles capable of speeds of 300 mph for use on Interstate highways.

I was recently struck when an acquaintance ran out of "cloud storage" space and was encouraged by their provider to buy more. They were storing a handful of "web pages" containing notes along with associated photos captured on their cell phone. I looked at one page, which alone took 1.5 GB of cloud space, and contained about 20 photos. The phone came set up to capture 16 MP photos, which were typically compressed to about 4 MB each for local phone storage. But when a photo was inserted into the page and synced to the cloud, it was stored uncompressed, or 50 MB each. This still only came to about 1 GB, but it turned out when a photo was 'deleted', its space was not reclaimed, yielding the stored cloud total of 1.5 GB. Not surprisingly, the very well known provider that charges for the cloud storage, wrote the app that formatted the pages. Using a 15-year-old computer application, I was easily able to format the same document to less than 3 MB in a manner my acquaintance could not see any difference. Needless to say a 500-fold increase in 'justifiably needed' bandwidth to synchronize cloud storage and allowing others to access web pages is entirely absurd and would be irresponsible.

I believe the mobile wireless market has largely been saturated in terms of the number of available users, and their needs for content. Any claim by the mobile wireless companies to the contrary reflects more their desire to mislead and force consumers to pay for meaningless changes that require more and more bandwidth, and more and more spectrum reallocations. This costs consumers dearly with no increase in the public good. The useful electromagnetic spectrum is fixed size. It will eventually run out. The sooner the mobile wireless industry is forced to work with what is available, the sooner they will develop innovative technologies in the manner the result of the industry has for the past ~100 years.

Will the Commission Accurately Count Users of the 3.7-4.2 GHz Spectrum?

In freezing new applications for C-band earth stations, but allowing a 90 day period for operators of unregistered but existing earth stations (as of 19 April 2018) to file, the Commission believes it will form a more accurate picture of the quantities and locations of existing satellite users of the 3.7-4.2 GHz spectrum, and can use this information to assess impacts and costs of spectrum sharing with/reallocation to mobile wireless use of this band. This action is unlikely to provide what the Commission claims to be seeking. Presumably all of the unregistered operators are using their satellite dishes for receive only purposes, and many are thus unaware of this existence of this action, because the Commission has never required them to register such earth stations in the past.

Many such operators are small companies or private dish owners who lack the technical abilities to provide the detailed filing requirements imposed by the Commission, and also lack the financial ability to meet the filing costs required. The latter were not waived by the Commission, in spite of the fact that none of this class of earth stations requires any regulatory action by the Commission. A waiver process is alluded to, but it appears this will be granted only under exceptional circumstances, and it also appears the fees must be paid first for a waiver to be considered. In my particular case and because of my technical background, I could likely produce the technical detail required for each of my C-band satellite antennas, but I would have to pay the Commission around \$5,000 in filing fees. This is an undue burden to me and anyone else who is operating a satellite dish for private television reception and data capture. By my limited and anecdotal access to the relevant statistics, I believe the Commission will undercount the number of operational C-band satellite antennas by anywhere from the thousands to tens of thousands. Thus any estimate the Commission obtains will be meaningless and not likely to be useful in assessing the true impact of mobile wireless spectrum use on satellite signal reception.

The Commission should provide a straightforward and zero-cost means for all unregistered earth station operators to duly show their true use of this portion of the electromagnetic spectrum.

Who Would Be a Party to 3.7-4.2 GHz Reallocations?

Clearly the mobile wireless industry is actively engaged in this process, and presumably has some willingness to compensate existing users of the satellite C-band spectrum for loss-of-use or spectrum compaction as has been accomplished with other spectrum reallocations. It is also clear Intelsat and SES see this as a financially rewarding opportunity, as does the stock market for them. Not only will they demand payment for the loss-of-use of their existing satellite C-band capacity, but they will also expect higher fees for transponder rentals because of a diminishing resource to be shared over the same set of users. They may also explore adding additional satellites to fill unoccupied orbital locations, and could conceivably suggest tightening the current 2 degree orbital separation constraints. All of this they will expect to be paid for.

It is less clear at what level the earth station operators would be compensated for their losses and equipment costs. There are potentially many tens of thousands of C-band satellite antennas that would become less functional or completely non-functional by the introduction of terrestrial mobile wireless base stations and users.

Others have assessed the hypothetical impact of reallocating the 3.7-3.8 GHz spectrum for mobile wireless use. Initial calculations suggest this will cause existing LNBs on C-band satellite dishes to saturate, lowering received CNRs potentially to link threshold levels, even though the emissions would be out-of-band. This occurs already in my location because of aerial radio altimeters, and has required me to install pre-LNB filters to attenuate energy levels outside of the existing 3.7-4.2 GHz bandwidth. Similar filters could be designed to attenuate mobile wireless signal levels, but this could require a further 50-100 MHz for the filter transition between maximum and minimum attenuation. Thus while Intelsat and SES would like to believe they could immediately make 100 MHz of spectrum available, the real loss to the satellite C-band spectrum could be closer to 200 MHz.

My existing C-band filters for aerial radio altimeters cost about \$400 per polarization, and I have 13 operational orthomode feeds on my 8 C-band capable satellite dishes. None of my existing filters would provide any attenuation of mobile wireless signals, and replacing them with comparable technology would cost in excess of \$10,000 for parts alone. As a private citizen, my situation may be unusual, but for a small cable company, television or radio station, a religious programming uplinker, these costs would also have to include logistics, planning, and installation. It could also cost a completely new satellite dish. For less complex Free-To-Air (FTA) private earth station operators, the impact costs would likely exceed the investment in their earth stations. As many of these operators are retired and/or live in rural areas, much of this still represents an undue burden.

I could well expect that corporations operating large farms of satellite dishes would expect some compensation for reconfiguring their C-band satellite antennas to function in a spectrum sharing arrangement with mobile wireless use. And they will likely be compensated. But the smaller cable TV operators, radio and television stations, and private C-band operators are no less impacted and deserve their costs to be covered in an identical manner.

If the Commission effectively and selectively prevents these smaller operators from registering their satellite antennas, how will the Commission even know the financial burdens they will have to bear? The Commission must consider the widely ranging impacts to the full existing 3.7-4.2 GHz community. It is not limited to Intelsat and SES, and they do not represent anyone but themselves.

Why Do I Care?

My interest in the C-band satellite spectrum is partly technical, and partly because my family and I legally watch video services we cannot obtain in our area from any other source, paid or not. We also enjoy the higher video and audio quality available on C-band, that suffers considerably on redistribution through providers that overly compress the data. And we still subscribe to several paid content providers. All of our services are complementary.

I do wish to speak for the many friends and acquaintances that share the hobby of legal, FTA satellite reception. Just as with amateur radio enthusiasts, their use of this part of the electromagnetic spectrum is part of the public good. It may be dwarfed by the number of people in the United States who directly or indirectly benefit from the 3.7-4.2 GHz spectrum for satellite use, whether from the distribution of video and audio content for radio and television OTA broadcast, cable TV, DBS satellite TV, news gath-

ering, live sports event feeds, emergency services, Internet, weather services, and I'm sure many others. But plenty of the people who operate private FTA satellite antennas cannot afford to obtain their content in any other manner and/or live in rural areas where meaningful Internet bandwidth is unavailable. Taking away the use of this spectrum will effectively relegate them back 100 years technology-wise.

The benefits of satellite C-band to the United States public and government is immense. Reducing a well-run and efficient service that does not interfere with anything else is a questionable proposition at best. I believe it is entirely the wrong strategy to turn over spectrum to mobile wireless companies, who continually demonstrate utter disregard for responsible spectrum use, employ unused public spectrum for their own financial speculation, and make unsupportable claims that they will require never ending increases in their spectrum use to meet their artificially manufactured needs of their customers. This is tantamount to a pyramid scheme that needs to be managed by technology innovation, and not by whining, spoiled attention seekers.

Respectfully yours,

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